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(54) REPLICATION FILE REFERENCING SYSTEM

(57)Abstract:
PURPOSE: To provide a system for efficiently using a replica server instead of a file server in a distributed data processing system.
CONSTITUTION: A client 120 connected to a communication network 152 gives the reference request of a file 112 in a file server 110 through a communication network 151. When a replica 122 is stored in the disk of the client 120, a gate 140 in the mid-way of a path recognizes it and pieces of information specifying 110, 112, 120 and 122 are written

in an update fact table 143. When a client 130 refers to the file 112, the gate 140 in the mid-way of the path recognizes the reference request and alters the reference request to be transmitted to the file server 110 in an original case so that it is to be transmitted to the client 120. The client 120 plays the role of the replica server only to the file 112.

CLAIMS

[Claim(s)]

[Claim 1] Consist of two or more communication networks, and each communication network is equipped with the gate which controls two or more data processors which have a file storing means, and communication between communication networks. It is a rep RIKETO file reference method in the distributed data processing system in which communication between data processors is possible. Said gate The file in which the data

processor in a self-communication network exists in the file server in other communication networks is referred to. It has the updating fact table which had the information which specifies the data processor (replica server) with which said file server and file which show that the rep RIKETO file was stored in the file storing means, and a rep RIKETO file exist, and its rep RIKETO file registered. The communication to the data processor in the other communication networks from the data processor in a self-communication network is supervised. When it investigates whether this file server and the file are registered with reference to said updating fact table when this communication is what refers to the file which exists in a file server, and not registered, Permit communication with this file server and a file server, a file, and the data processor of a communicating agency are recognized from a communication result. When the information which specifies a file server, a file, the data processor (replica server) that is a communicating agency, and its rep RIKETO file is registered into said updating fact table and it registers with it, The rep RIKETO file reference method characterized by being constituted so that the reference place of a file may be changed into the replica server in which the rep RIKETO file of a file exists from said file server and the data processor of a communicating agency can refer to a rep RIKETO file.

[Claim 2] It is the rep RIKETO file reference method characterized by forming the reception place modification authorization flag which permits changing a reception place into said replica server from a file server to said gate into the transmit data at the time of said data processor communicating with a file server in a rep RIKETO file reference method according to claim 1.

[Claim 3] In a rep RIKETO file reference method according to claim 1 said file server According to the file reference demand from a data processor, rep RIKETO file permission data are added to the file information of a communication result. Said data processor creates a rep RIKETO file based on said rep RIKETO file permission data. Said gate The rep RIKETO file reference method characterized by detecting said rep RIKETO file permission data, and updating said updating fact table based on these authorization data by supervising the communication on said communication network.

[Claim 4] In a rep RIKETO file reference method according to claim 3 said file server The data which show an effective reference term to said rep RIKETO file permission data are added. Into the transmit data at the time of communicating with a file server, said data processor forms the newest replica reference flag which shows the reference demand of the newest rep RIKETO file. Said gate Modification time is registered with said effective reference term at the time of the renewal of said updating fact table based

on said authorization data. A reference place is changed into the replica server in which the newest rep RIKETO file exists when said newest replica reference flag is set up into the transmit data of a data processor. The rep RIKETO file reference method with which said effective reference term is characterized by changing a reference place into the replica server in which the longest rep RIKETO file exists when said newest replica reference flag is not set up.

[Claim 5] In a rep RIKETO file reference method according to claim 1 said gate A data delivery means to control communication with the data processor in a self-communication network, and the data processor in other communication networks, A communication monitor means to supervise the contents of said communication, and an updating fact cognitive means by which the commo data sent from said communication monitor means recognizes that it is a thing about a rep RIKETO file, and updates said updating fact table, It recognizes that the commo data sent from said communication monitor means is the file reference demand to a file server. A reference demand cognitive means to pass control to a postscript reference place modification means while applying interruption to said data delivery means and stopping delivery of the commo data to other communication networks, The rep RIKETO file reference method characterized by having a reference place modification means to change the reference place of a file with reference to said updating fact table based on said commo data, and to direct this modification for said data delivery means.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the suitable rep RIKETO file reference method for employment with the sufficient effectiveness of the rep RIKETO file in a distributed data processing system.
[0002]
[Description of the Prior Art] A distributed data processing system is a system which carries out each processing, connecting two or more data processing system, such as a

personal computer and a workstation, to the communication network called LAN (Local Area Network), and delivering and receiving information through a communication network mutually. There is a distributed file system which enables access of the file which exists in other data processing system from one data processing system on a communication network as an important technique in a distributed data processing system. A distributed file system enables two or more data processing system to share the file which exists in one data processing system. Here, the data processing system which accesses the data processing system with which the file shared exists at the shared file on a file server, and a call and a file server will be called a client.

[0003] If a specific shared file is accessed frequently, a demand may concentrate on the file server and it may become a bottleneck on the engine performance of the whole distributed data processing system. Then, by putting the copy of this file also on the 2nd file server, and processing a part of access request to this file by the 2nd file server, a load distribution is carried out between two file servers, and aiming at the dissolution of the aforementioned bottleneck is performed. Since access to that of the file concerned is not interrupted and recovery also becomes easy by using a copy as an alternative even if file destruction occurs by putting the copy of the same file on two or more data processing system, it also becomes the improvement in dependability of the whole distributed data processing system. It is called replication to create the replica of the file or a rep RIKETO file and a call, and a copy for each of the copy of the same file, and the data processing system which owns the copy of a file is called replica server. a distributed file system -- an A CM and computing Sir BEIZU -- No. 4 (1990) is explained in PP 321-374 (ACM, Computing Surveys, Vol.22, No.4(1990) PP 321-374), and the 22nd volume is discussed by PP 339-340 of this reference about replication.

[0004]

[Problem(s) to be Solved by the Invention] Employment in the network of a global scale where the distributed file system interconnected not LAN but LAN of ** - will be expected from now on. For example, it uses in order to refer to the file in the office in the U.S. from the office in Tokyo or Osaka. The use of replication then mentioned above becomes important, when controlling concentration of the overhead of the file server in a worldwide scale, and the increment in traffic. If it says in the upper example, the client of Tokyo and Osaka will examine how to access a duplex in the U.S., and how a U.S. replica server is put on Tokyo and the client in Japan accesses a replica server. Compared with the former, generally the time amount which requires latter one for a communication link is also short, and does not have the overhead of a U.S. file server, either.

[0005] However, it is actually a problem where a replica server is put. Conventionally, the server only for replication was installed about the file server which exists in a long distance (U.S.). The client needed to have the step which was conscious of the whereabouts of a dedicated server, and refer to the replica for it. Moreover, concentration of access to the replica server by two or more clients will be inevitably large in the overhead of processing of a replica server, and will increase the traffic of a communication network. The technical problem of this invention is to offer the rep RIKETO file reference method carried out as [refer to / instead of a file server / the replica in a replica server], in case the client which referred to the file in a long-distance file server first is made into the replica server of the file and other clients refer to the file in a file server.

[0006]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, this invention prepares an updating fact table in the gate which controls communication between communication networks, and the information which specifies in the data processor (a replica server) with which said file server and file which shows having stored the rep RIKETO file in the file storing means with reference to the file to which the data processor in a self-communication network exists in the file server in other communication networks in this updating fact table, and a rep RIKETO file exist, and its rep RIKETO file is registered. Said gate supervises the communication to the data processor in the other communication networks from the data processor in a self-communication network, and when it is what refers to the file in which this communication exists in a file server, it investigates whether this file server and the file are registered with reference to said updating fact table. And when not registered, communication with this file server is permitted, a file server, a file, and the data processor of a communicating agency are recognized from a communication result, and the information which specifies a file server, a file, the data processor (replica server) that is a communicating agency, and its rep RIKETO file as said updating fact table is registered.

[0007] When registered, the reference place of a file is changed into the replica server in which the rep RIKETO file of a file exists from said file server, and the data processor of a communicating agency enables it to refer to a rep RIKETO file.

[0008]

[Function] Since the reference demand place of a client is changed into a replica server from a file server when there is a replica server which stores the rep RIKETO file of the file to which a client exists in the file server which requires reference, it can

communicate at a high speed far and efficient file reference is attained rather than it communicates with a file server. Moreover, concentration of network traffic and the burden of a server decrease by not having a specific exclusive replica server. Furthermore, when two or more rep RIKETO files of the same file exist by adding the information on the expiration date of a rep RIKETO file, reference of the optimal rep RIKETO file is made easy.

[0009]

[Example] Hereafter, the example of this invention is explained using drawing. <u>Drawing 1</u> is the block diagram having shown the outline of the distributed data processing system which can apply this invention. It is the data processing system which became independent, respectively, and each data processing system is connected to the common communication networks 150 and 152, and a communication link and data transfer are possible for the clients 120 and 130 which are the data processing system which accesses the shared file on the file server 110 which is the data processing system with which the file shared exists, and a file server to mutual through a wide area network 151 in between the gate 140 and the gate 142. Each gate consists of data processing system, and the communication fact table 143 is connected to the gate 140. For example, a file server 110 and clients 120 and 130 are highly efficient workstations (WS), the gate 140 is the exchange in which high-speed memory access is possible, the updating fact table of 143 is on memory, and the example of a typical configuration uses a Local Area Network (LAN) as a communication network. The file server 110 and the client 120 have disk units 111 and 121 for file storing, respectively, and refer to the files 112, 113, and 122 stored there for them from a client 130.

[0010] The specific file 112 is considered. First, a client 120 requires reference of a file 112 of a server 110. A server 110 permits creating a replica file to a client 120. A client 120 stores the copy of a file 112 in a disk unit 121 as a replica file 122. The client in which a replica file exists is called replica server. The client 120 in which the replica file 122 exists becomes a replica server. The data which permit a replica during this activity of a series of pass through the gate 140. Said replica authorization data are added to the copy body of a file 112, or before a copy, are separate mail and are transmitted to a client 120 from a server 110. When the gate 140 supervised and discovers the replica authorization data which transmit a network top, it stores in its table 143 the updating fact that the replica of the file 112 of a server 110 was created under management of a client 120.

[0011] Then, when a client 130 requires reference of a file 112 of a server 110, the gate 140 recognizes the demand fact of transmitting a communication network, and searches

said updating fact table 143. When the reference place which the demand fact shows, and the updating place which the updating fact shows are in agreement, the reference place of a client 130 is changed into the replica server 120 from a server 110. Therefore, the replica server 120 processes the file reference demand of a client 130. A client 130 will access a replica 122 instead of a file 112.

[0012] Drawing 2 is the conventional block diagram. It is the big difference from drawing 1 that the replica server 220 of dedication exists. Among drawing 2 , although a client 230 and the replica server 220 are on the same communication network 252, it exists in a separate network in fact in many cases, and a client 230 does not know existence of the replica server 220 in many cases. Therefore, a client 230 goes the replica 221 in the replica server 220 to not knowing to refer to [of the file 211 in a file server 120].

[0013] In this example, it is the description that a client becomes the replica server of each file without placing the replica server of dedication. In drawing 1 , another file 113 is stored in the disk 131 of a client as a replica 133. Therefore, clients 120 and 130 serve as a replica server of a file 112, and a replica server of a file 113, respectively. The gate 140 takes charge of the processing which changes a file reference place into a replica server at the time of demand passage that clients 120 and 130 should perform only processing which requires the file reference to a file server 110. The communication link through a communication network is performed by capturing to the protocol which defined the communication procedure of a transmitting side and a receiving side, and the specification method of the data processor which should be received, i.e., the specification method of the address, includes it in this. It is carried out by the data transfer's itself generating an electric vibration on a channel, or detecting it, and each data processing system reads the address information contained in the detected electric oscillation, and a communication link is materialized by judging whether it is the communication link to oneself.

[0014] Drawing 3 shows the configuration of the gate 140. The conventional gate 240 has only a data delivery means 300 to send the data between a communication network 250 and 252 mutually. The gate 140 of this example has the reference place modification means means 301, the updating fact cognitive means 302, the reference demand cognitive means 303, the communication monitor means 304, the updating fact table 143, and connectors 310 and 311 independently of the data delivery means 300. It is a processor with separate means 300-304, and a multiprocessor configuration is taken and each processor operates under a separate program. As for the updating fact table 143, it is desirable that it is data which exist on the memory which means 301-303

access in common, after data processing's accelerating. In addition, without making means 300·303 into a separate processor, you may constitute from one processor and it is not necessary to say that it is good also as a multiprocessor configuration of the small number.

[0015] Drawing 4 is one example of the updating fact table 143. It constitutes from a column 401 which shows an updating agency (server), a column 402 which shows an updating place (client), and a column 403 which shows the expiration date specified by an updating place. For example, the data of the character string with which the data of a column 401 and a column 402 combined the network address and file name of data processing system, and a column 403 are an integer which shows time of day at the time of the global standard.

[0016] Drawing 5 shows procedure when the gate 140 receives the commo data of renewal of a replica. Steps 501·503 are procedures which send commo data, and are the procedures in which steps 510·511 recognize update information. Drawing 6 shows procedure when the gate 140 receives the commo data of file reference. It is the procedure in which steps 601·04 send commo data, and steps 610·615 are the procedures of changing the reference place of commo data.

[0017] Hereafter, according to this example, actuation of the gate 140 is explained using drawing 1 and drawing 3 · drawing 6 . First, actuation in case a client 120 refers to a file 112 to a server 110 is explained. The connector 310 which is an interface with a communication network 152 processes the communicative destination address other than electrical installation. That is, when the appointed address is the address of network 150 direction, commo data is incorporated and the processing is made to carry out to the data delivery means 300 (step 601). The data delivery means 300 sets commo data by the protocol of a wide area network 151 (step 602), and transmits commo data from a connector 311 (step 603).

[0018] The commo data of a file 112 and the data in which replica authorization is shown are answered by the data delivery means 300 through a connector 311 (step 501). The data delivery means 300 sets commo data by the protocol of a communication network 152 (step 502), and transmits it from a connector 310 (step 503). In that case, the communication monitor means 304 supervises the signal which a connector 311 sends to the data delivery means 300 (step 510), and transmits a signal to the updating fact cognitive means 302. When commo data has recognized it as the data which a replica updates, the updating fact cognitive means 302 is a format as shown in drawing 4 , and stores the updating fact in the updating fact table of 143 (step 511).

[0019] Below, actuation in case a client 130 refers to a file 112 to a server 110 is

explained. A reference demand passes through the gate 140 through a connector 310, the data delivery means 300, and a connector 311 (steps 601-603). The communication monitor means 304 supervises the signal which a connector 310 sends to the data delivery means 300, and transmits a signal to the reference demand cognitive means 303 (step 610). The reference demand cognitive means 303 interprets a signal, if it gets to know that it is the file reference demand to a file server, it will search the updating fact table 143 (step 611), and it checks whether the same file already exists in a communication network 152 as a replica. Processing is ended when the updating fact does not exist in the updating fact table 143. When the updating fact exists in the updating fact table 143 (step 612), the reference demand cognitive means 303 interrupts the data delivery means 300, and applies 615 (step 613), and it stops that the data delivery means 300 sends a file reference demand to a communication network 151 through a connector 311 (step 604). The reference demand cognitive means 303 passes control after a termination to the reference place modification means 301. The reference place modification means 301 changes the reference place of data based on the updating fact of the updating fact table 143 (step 614). The data delivery means 300 sends a reference demand to the replica server of a modification place (step 616), and the replica server 120 of a modification place sends reference data to a client 130 (step 617).

[0020] Next, the data transfer after modification of the reference place of the data shown at step 614 of drawing 6 , step 616, and step 617 and modification is explained using the example of the transmit data 700 from the client 130 shown in drawing 7 to a file server 110, and the received data 710 obtained as a result. The reference demand 700 contains the flag 704 (for example, code of a bit string) which permits that the data division 703 which show the reference demand of a header for the address 702 grade of the address 701 of a transmitting agency or a reception place to communicate and the specific file 111, and the gate 140 with the updating fact table 143 may change a reception place. Moreover, a flag 705 is the newest replica reference flag (about this, it mentions later). The communication monitor means 304 determines to perform processing of henceforth for referring to the replica server 120 instead of a file server 110, when the flag 704 of a reference demand is set up. If processing (steps 611-614) for referring to the replica server 120 will be performed and a reference place will be changed, the reference place modification means 301 will be overwritten to the address 701 of a reception place with which the client 130 specified the data of the address of a reception place in which the replica server 120 is shown. The data delivery means 300 and a reference demand are sent to the replica server 120 of a modification place instead of a file server 110. 710 contains the data division 713 which show the address

711 of a client 130, the address 712 of the replica server 120, and the contents of the file server, and the flag 714 which shows that it is data from not a file server but the replica server 120 as a result of the reference demand 700 which the replica server 120 sends to a client 130.

[0021] In the another example of step 614 of <u>drawing 6</u> of this invention, it has an updating fact table 143 like <u>drawing 9</u>, and as shown in <u>drawing 8</u>, in case two or more rep RIKETO files of the same file exist, the procedure of referring to the replica (the newest replica) which passed through the gate 140 at the end, or a replica (the longest effective replica) with the longest expiration date of reference is offered. The updating fact table 143 of <u>drawing 9</u> shows an example when the original file name 901 which combined Server Name and a file name, the file name 902 which combined replica Server Name and a rep RIKETO file name, the expiration date 903 of the replica notified from the file server, and the time of day 904 which updated the data of items 901-903 when it passed through the gate are included. In <u>drawing 8</u>, whether the newest replica reference flag 705 (for example, bit string) with which the reference place modification means 301 is included in the reference demand 700 which the client 130 transmitted is set up judges (step 801). In case the file name 703 which is in agreement with the file 121 of a reference demand exists, when the newest reference flag 705 has set up, the file updating time of day 904 is searched, the rep RIKETO file 902 of the newest modification time is made into a modification place (step 803), in not setting up, it searches the expiration date 903 of a replica, and the expiration date of reference uses the longest rep RIKETO file 902 as a modification place (step 802).

[0022]

[Effect of the Invention] In the network which interconnects on a world-wide scale, instead of a client referring to the file in a file server by preparing an updating fact table in the gate in the middle of passage, and using this, the rep RIKETO file in a replica server can be referred to, and, according to this invention, there is effectiveness which enables high-speed file reference. Moreover, by not placing a specific exclusive fixed replica server, concentration of traffic is avoided, the load distribution of a distributed file system is promoted, and there is effectiveness which the burden of a server lessens. Furthermore, when two or more rep RIKETO files of the same file exist by adding the information on the expiration date of a rep RIKETO file, there is effectiveness which makes reference of the optimal rep RIKETO file easy.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the block block diagram showing the outline of the distributed data processing system which is a candidate for application in one example of this invention.

[Drawing 2] It is the block block diagram showing the outline of the conventional distributed data processing system.

[Drawing 3] It is the block diagram showing the configuration of the gate.

[Drawing 4] It is drawing showing the structure of an updating fact table.

[Drawing 5] It is the flow chart which shows the processing in the gate when the gate receives the commo data of renewal of a replica.

[Drawing 6] It is the flow chart which shows the processing which changes the reference place in the gate.

[Drawing 7] It is drawing showing the received data obtained as a result of [its] the transmit data from a client to a file server.

[Drawing 8] It is the flow chart of the replica reference processing at the time of two or more rep RIKETO files of the same file existing.

[Drawing 9] It is drawing showing an example of an updating fact table.

[Description of Notations]

110 File Server

111, 121, 131 Disk

112 113 File

120 130 Client

122 133 Replica file

140 Gate

143 Updating Fact Table

150 152 Network

151 Wide Area Network

300 Data Delivery Means

301 Reference Place Modification Means

302 Updating Fact Cognitive Means

303 Reference Demand Cognitive Means

304 Communication Monitor Means

310 311 Connector